grippers are in line with one another during the transfer [between them] of the flip chips therebetween.--

--4. (Amended) The device as claimed in [one of the preceding claims, characterized in that] claim 3, wherein a clearance between the holders [(7)] directed oppositely facing each other and in line with each other in the transfer position [there is a clearance, which] is somewhat larger than the thickness of the flip chips [(6)].--

--5. (Amended) The device as claimed in [one of the preceding claims, characterized in that] claim 4, wherein the first and [second] downstream holding stations are arranged immediately following each other.--

~~Description~~ TITLE

Device for placing flip chips on a substrate

BACKGROUND OF THE INVENTION

The invention relates to a device for placing flip chips on a substrate in the form of a leadframe. The device has a movable placement head, which picks up the flip chips from a stock of components and places them on the substrate.

Flip chips of this type are usually presented with their connection elements pointing upward. What are known as wafer handlers are provided with a turning device for the flip chips, so that the placement head, which can move in a placement plane, of a placement device can pick up the flip chips in their correct insertion position and place them onto a printed-circuit board at the intended position for this purpose.

The flip chips are presented, for example in accordance with JP 161027 A (cf. Patent Abstracts of Japan, vol. 13, No. 270, of July 21, 1989), in a wafer with their connection elements pointing upward. A movable removal head of a wafer handler removes the flip chips from the wafer and deposits them on a stationary turning device, by means of which they are deposited in a turned position on a transfer station, from which the removal head picks them up and places them in the correct insertion position with the connections downward onto a semiconductor substrate, which is usually in the form of a strip-like leadframe for the production of packaged components and is passed through the placement station in a cyclical manner.

~~Furthermore,~~ US 5 839 187 discloses a device for the handling of flip chips, in which the flip chips are removed from a wafer by means of a gripper. The gripper is pivoted about a horizontal axis and, turned

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in a transfer station, transferred to a positioning gripper, which deposits the flip chips into a flat magazine.

Furthermore, US 5 667 129 A (claim 7) discloses a placement head for plucing flip chips on a substrate, the placement head having a turning device (not represented in any more detail) for the flip chips.

Summary of the Invention

The invention is based on the object of reducing the complexity of a device for the placement of components on the substrates.

Insert A (from page 2a)

This object is achieved by ~~the invention according to claim 1.~~ The freely positionable placement head can be moved in a positioning system in such a way that its range of movement covers the entire area of the wafer and the fixed substrate, for example in the form of a printed-circuit board. The placement head can therefore remove the flip chips directly from the wafer, move over the substrate, turn ~~its~~ the accompanying turning device in the time between the pickup and placement on the substrate and, after turning, place the flip chips onto the substrate. This measure allows all the essential functions of the pickup, transportation, turning and placement of the components to be carried out with a single handling system in a time-saving manner, ~~making~~ it possible to dispense entirely with the wafer handler. The use of a turret placement head makes it possible to pick up a multiplicity of flip chips in rapid succession from the wafer and turn them between two holding stations. Subsequently, the multiplicity of flip chips held on the grippers are placed on the substrate in just as rapid succession. This reduces the number of movement operations ~~considerably~~, which is accompanied by a corresponding time saving. The placement head also has the advantage that a single turning station is required

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